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CURRENT NOTES ON CHEMISTRY.—V.

[Edited by Charles Platt, Ph.D., F. C. S. Lond.]

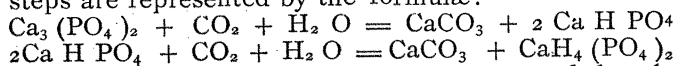
EDUCATION OF INDUSTRIAL CHEMISTS.

AMONG the most valuable of the papers presented at the World's Congress of Chemists were those in discussion of industrial chemical education. Any four years' collegiate course in chemistry may graduate an analyst: one who is content to remain forever a laboratory employee grinding out results,—and parenthetically let it here be said, that the young graduate need expect nothing but a "grind" in any laboratory. He may have dreams of research and private study, but a few months' time will dispell these with unpleasant forcibleness. He will find that each day brings a mass of routine work, and chemical analysis rapidly degenerates into mechanical manipulation. We do not say this by way of discouragement; analysts are necessary, and many find here the greatest pleasure in their work, but there is needed, too, another class of workers, not higher in dignity maybe, but different in kind; we mean chemical engineers, or, to use the rather awkward designation, industrial chemists. By this we mean men capable of taking hold of the greater operations of the chemical works, capable to superintend, to construct, to alter and improve machinery, to interpret analytical results and to use them in the refinement of processes; in other words, men to comprehend the process as a whole, not only the chemical reactions but also the mechanical means used in their perfection. It is a simple matter to dissolve, precipitate, filter, and dry, in the laboratory, but how is this to be done when there are thousands of gallons to be handled, and this, too, with the greatest economy of labor, of power, and of time? It is true we have catalogues describing apparatus, etc., but of twenty patterns which is to be adopted? An experiment will cost thousands of dollars, and yet it is only the best, the most suitable type of apparatus which will allow the manufacturer to enter the market with his competitors. More than likely, too, *none* of the apparatus catalogued will exactly answer the conditions, and alterations must be made.

It may be said in truth that the chemical engineers of to-day are born, not made, for while there is a beginning in two or three of our technical schools the ideal course in chemical engineering is still of the future. It might be added, however, that the technical schools are the only places in the country in which to learn chemistry for practical purposes of any kind whatever. The larger universities, even those with elaborate post-graduate courses, are fitting preparation for teaching and scientific research, but not for the industrial laboratory.

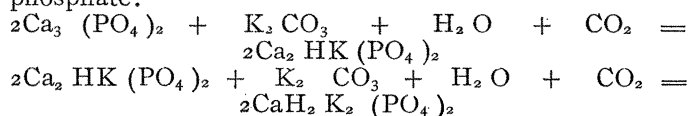
REDUCTION OF PHOSPHATES AND THE PREPARATION OF COMMERCIAL FERTILIZERS.

A PRACTICAL process for the reduction of phosphates in which carbonic acid is substituted for the usual mineral acid has been proposed by C. Seybold and F. Heeder, (Deut. landw. Presse, 20, 1883, No. 64). The simplicity and increased applicability of the new process makes it of great interest in the production of fertilizers. The procedure is as follows: The phosphate is finely ground, moistened with water and spread in a chamber heated gradually to 120° C, through which a current of carbonic acid with steam is passed. The successive steps are represented by the formulæ:



The alkali-calcium phosphates are prepared by the

addition of carbonate of potash or soda to the moistened phosphate:



The by-products are omitted in the above equations. In the preparation of nitrogenous fertilizers the organic nitrogenous substances (hair, hoof, leather, tanhage, etc.,) are dissolved in alkali carbonates with the addition of lime, or in caustic alkalies alone, and the ground phosphate is placed in this solution and treated as described above. To obtain a nitrogenous fertilizer of the composition of ordinary guano, 500 pounds of nitrogenous refuse is dissolved in 50 parts of carbonate of potash decomposed with heat by 50 parts of caustic lime, and 500–600 parts of bone meal are added. In the reduction of bone meal the process is as follows: The material is finely ground and mixed with about half its weight of water and spread in the drying oven. Steam is admitted with the gaseous products of combustion, the temperature being kept at about 60°–80°C. The time of treatment necessary, is reduced when alkali carbonates are used. The end product is regulated by the amount of alkali used, by the temperature of the oven, and by the duration of treatment. Among the advantages claimed for this process are the absence of injurious sulphates and the production of a cheap available phosphate, utilizing heretofore rejected nitrogenous substances.

VOLATILIZATION OF METALS AND OXIDES IN THE ELECTRIC ARC.

M. MOISSAN continues his interesting experiments at high temperatures, and the results are as before almost incredible. Condensation in these 'present experiments is obtained by the introduction of a copper U-tube, through which a rapid current of cold water is continually passed, immediately above the crucible in the furnace. Asbestos board is placed above the opening through which the U-tube is introduced. Magnesium pyrophosphate in the arc produced by a current of 300 ampères and 65 volts produces a sublimate of magnesium oxide and ordinary phosphorus. Asbestos completely volatilizes in a few minutes under 300 ampères and 75 volts. Copper with 350 ampères and 70 volts volatilizes rapidly and condenses in globules. In contact with the air cupric oxide is formed. Silver readily boils and distils, condensing in globules, or in a gray powder or in aborescent fragments. Platinum melts almost immediately and very soon begins to volatilize, condensing in brilliant globules or in powder. So also aluminum, tin, gold, manganese, iron, uranium, carbon, calcium oxide and magnesium oxide all melt, boil and distil over!

Zirconia heated in an electric arc of 360 ampères and 70 volts rapidly melts and in a few minutes is in rapid ebullition. If the zirconia be mixed with an excess of carbon, a residue of zirconium carbide is left, containing from 4.22 to 5.10 per cent of carbon. If this be fused with excess of zirconia pure zirconium is obtained, Sp. Gr. 4.25, scratching glass and ruby easily. A button of zirconium is also obtained as a residue by fusion of zirconia in the electric arc in absence of an excess of carbon. Silica in an arc of the same intensity melts almost immediately and in a few minutes is in complete ebullition.

NATIVE SODA, WYOMING.

H. PEMBERTON, JR., and G. P. TUCKER give analyses of the deposits of sodium sulphate occurring in the dry region of the high Wyoming plateau, near the town of Laramie. The lower and greater portion of these de-

posits, known as the "solid soda," consists of a mass of crystals mixed with a considerable amount of black slime. Analysis shows: Na_2SO_4 , 36 per cent; CaSO_4 , 1.45 per cent; MgCl_2 , 0.77 per cent; NaCl , 0.21 per cent; H_2O , 46.87 per cent; insoluble residue, 13.86 per cent. The upper part of the deposit from 3-12 inches thick is formed by solution from the upper layers of the lower part, and by subsequent evaporation or cooling of the solution. Calculated as anhydrous, the composition of this upper portion is: Na_2SO_4 , 99.73 per cent; MgCl_2 , 0.26 per cent; insoluble matter, trace. The article, however, as prepared at Laramie is said to be not so pure.

ARTIFICIAL PYROXENES, ETC.

A CONTRIBUTION to the artificial production of minerals in a general method for the production of anhydrous crystallized silicates is described by Dr. Hermann Traube. The amorphous hydrated silicate is precipitated from a solution of the salt of the metal by the addition of a solution of sodium silicate. The precipitate is heated to a high temperature for several hours with boric acid, and the anhydrous silicate is finally obtained in good crystals. Ebelmen has already prepared the mineral pyroxene by this method, but Dr. Traube extends its application to any of the corresponding metallic salts. For instance, beautiful crystals of zinc bi-silicate, ZnSiO_3 , are obtained by precipitating the hydrous silicate from a solution of ZnSO_4 by addition of sodium silicate. The precipitate is ignited with eight times its weight of fused boric acid and finally the boric acid not volatilized is leached out with water. The crystals of ZnSiO_3 occur as transparent prisms with domal terminations. By the same method the mixed silicates of this class may be obtained.

STEREOCHEMISTRY AND MOTO-CHEMISTRY.

IN view of the recent extended study awarded this comparatively new field in chemistry, historical notes of its earlier conception become of interest. In addition to the hints regarding geometrical arrangement in space offered by Swedenborg, Wenzel, Biot, and some others, we have the same ideas foreshadowed in the writings of Wollaston and Ampère—quoted by Prof. John C. Cain, of Owens College, Manchester, in a recent letter to *Nature*. Wollaston in his paper entitled, "On Super-acid and Sub-acid Salts" (*Phil. Trans.*, Vol. XCVIII, 1808) discusses the constitution of the two oxalates of potash: "When our views are sufficiently extended to enable us to reason with precision concerning the proportions of elementary atoms, we shall find the arithmetical relation alone will not be sufficient to explain their mutual action, and that we shall be obliged to acquire a geometrical conception of their relative arrangement in all the three dimensions of solid extension... When the number of one set of particles (combined with one particle) exceeds in the proportion of four to one, then, on the contrary, a stable equilibrium may again take place if the four particles are situated at the angles of the four equilateral triangles composing a regular tetrahedron... It is perhaps too much to hope that the geometrical arrangement of primary particles will ever be perfectly known."

The same idea was developed later by Ampère in his "Letter to Berthollet" (1814), in which he considers the molecules as forming various geometrical figures dependent on the number of atoms contained therein.

Under the designation "Motochemistry" M. E. Molinari has recently discussed the hypothesis that the constitution of compounds is dependent on the intramolecular movements of the atoms in relation to one another,

rather than on their relative positions in space. The bonds by which it is customary to represent the union of atoms are taken as expressing the nature of the swing or energy of the atoms with regard to each other.

CONTINENTAL PHENOMENA ILLUSTRATED BY RIPPLE MARKS.

BY RICHARD E. DODGE, CAMBRIDGE, MASS.

A FEW days ago I saw at Winthrop Beach, Mass., some peculiar features of ripple marks that I thought might be of interest to the readers of *Science*.

Walking along the beach close to low-water mark, I noticed from a considerable distance a large number of peculiar markings upon the surface of the ripple marks, with which the shore was extensively corrugated. The sand of which the ripple marks were composed was very micaceous and much mixed with fine mud, so that it held a large amount of water between the particles. There was also a thin film of water on the surface of the deposits, partially held in position, I suppose, by cohesion. The ripple marks had an amplitude of about eighteen inches, and in the hollows between two adjacent marks the film of water was somewhat thicker than on the sides, so that a shallow basin was thus formed, bearing the same relation to the sloping sides of the ripple marks that the ocean itself bears to the adjacent continents.

After having noted the conditions mentioned above, I saw that the peculiar markings were due to the erosion caused by the water running down the sides of the ripple marks toward the hollows. The seaward sides of the marks were being worn away and dissected by a small river system developed thereon, and the waste thus derived was being deposited in the adjacent hollows. We have thus in these ripple marks, left uncovered by the receding tide, constructional forms similar to what we might expect to see when a warped coastal plain emerges from beneath the ocean.

As we would normally expect on such a constructional surface, we had developed at once a drainage consequent on the slope and structure of the materials of which the slope was composed. The streams, small as they were, followed all the laws of the largest continental streams, at once deepening mouthwards and lengthening headwards toward the divide formed by the crest of the ripple marks. Such small river systems were developed at frequent intervals along the slope of the ripple mark, each one having numerous tributaries and assuming a digitate form so familiar in rivers.

As soon as the small stream reached the level of the half-inch film of water in the basin between the ripple marks, erosion ceased and deposition began. In front of each small stream there was building out into the basin a small delta, but very broad and as deep as was the layer of water. The discharge of the minute fragments of waste from the streams was so rapid that I could watch the growth of the delta with ease and could note the building forward of the frontal slope and the building up of the top slope to the surface of the water, as has been described by Prof. W. M. Davis in his description of the growth of glacial sand plains. We thus had forming a small continental shelf similar to that off the eastern coast of the United States at the present time.

A more careful study of the processes in operation in these basins showed me that at certain places the small streams were developing alluvial terraces and at others building alluvial plains according to whether the stream was over or under-loaded with waste to be carried down